

and zinc; these waves are particularly interesting, as it would be practically impossible to obtain them by the "point-to-point" method, since arcs between carbon and metals burn very unsteadily. The arc, it will be seen, only burns for half a period; when the metal is positive (upper curves) the current is able to flow, and the P.D. and current curves have the shape characteristic of the same curves for the carbon arc, only somewhat accentuated; for the other half period, when the metal is negative no current flows at all, and the current curve is flat along the zero line, the P.D. curve being, in consequence, that given by the dynamo on open circuit. The three curves are for a frequency of 100 periods per second. Curve 4 shows the P.D. and current through the primary of an induction coil in which the contact-maker was driven by a motor, no condenser being used. The steady growth of the current and its rapid fall at break can be clearly observed in the current curve. From the P.D. curve it will be seen that the P.D. at the start is high, since, until the current begins to flow, the P.D. between

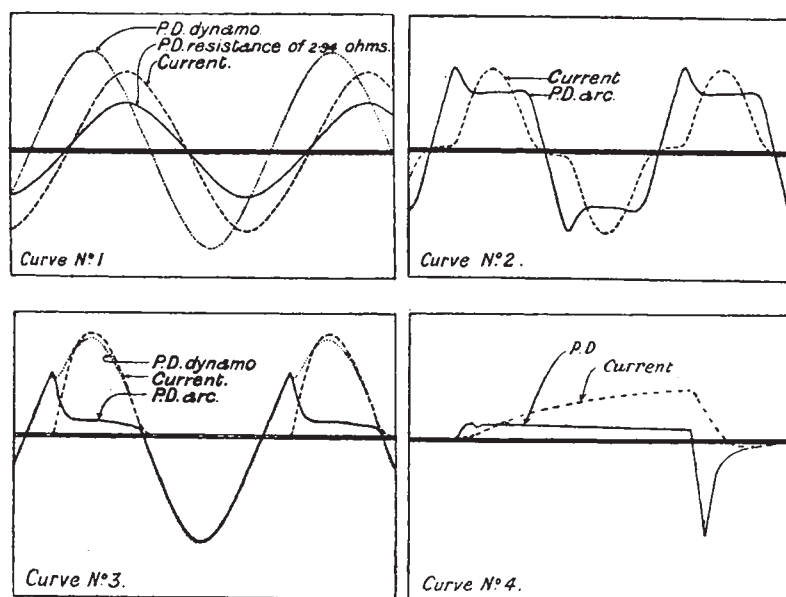


FIG. 7.

Data for Curves in Fig. 7.

No. of Curve.	Wave Forms for.	Periods per second.	Scale of P.D. Curve.	Scale of Current Curve.
1	Non-inductive Resistance.	100	1 mm. = 10 volts.	1 mm. = 2 amps.
2	Solid Carbon Arc.	100	1 mm. = 6 volts.	1 mm. = 2 amps.
3	Zinc-Carbon Arc.	100	1 mm. = 10 volts.	1 mm. = 2 amps.
4	Primary of an Induction Coil.	60 breaks	1 mm. = 2 volts.	1 mm. = 1 amp.

the terminals of the coil is equal to the E.M.F. of the cells. As the current rises, the P.D. between the terminals of the coil falls, due to the drop in volts in the circuit outside the coil; finally the break occurs and there is a large kick of the P.D. in the opposite direction to that applied.

From what has been said some idea will be gathered of the great value of the instrument that has been put into our hands by the invention of the oscillograph. To the scientific investigator it opens wide fields for experimental research, and it will enable the engineer to know more about the currents and E.M.F.'s with which he works. In addition, the projection oscillograph should prove invaluable for lecture and demonstration purposes, for even the simplest problems of alternate current working are by no means easy of comprehension by the average electrical student, who approaches them with only a bowing acquaintance with differential calculus and Fourier's theorem. The remarkable clearness with which their working can be demonstrated on the screen by the oscillograph will go a long way to give students a clear idea of their properties.

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UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Mr. T. Loveday, of Magdalen College, has been elected John Locke Scholar for the ensuing year.

Mr. G. C. Bourne has been re-appointed a delegate for the extension of University teaching.

The electors to the Wykeham Professorship of Physics have appointed Mr. J. S. Townsend, Fellow of Trinity College, Cambridge, and Demonstrator in the Cavendish Laboratory.

CAMBRIDGE.—The Clerk Maxwell Scholarship in physics is vacant through the election of Mr. J. S. Townsend to a professorship at Oxford. Candidates are to apply to Prof. J. J. Thomson by December 18.

The British Westinghouse Electric Company have presented to the Engineering Laboratory a valuable dynamo and other apparatus illustrating the generation and use of polyphase currents.

AN opportunity for seeing the Northampton Institute, Clerkenwell, and examining some of the work done in the laboratories, will be afforded to-morrow evening (December 7), when the annual prize distribution and members' and students' conversation will be held. Sir John A. Cockburn, K.C.M.G., will distribute the prizes.

IN an important article by Dr. William Wallace in the current number of the *Fortnightly Review*, on "the Scottish University crisis," attention is drawn to the urgent need there is for a greatly increased expenditure upon Scottish universities if they are to maintain the reputation they have enjoyed in times gone by. It is urged that a lump sum of not less than 1,500,000*l.* is required to place all the Scottish universities in such a position that their degrees should be regarded as of equal value with those of England, Germany, or even America. Such money is regarded as imperatively necessary for the following main purposes: (1) The conversion of the present skeleton faculties into real teaching organisations; (2) For laboratory and other scientific equipment; (3) For libraries; (4) For the endowment of industrial universities or of genuine industrial faculties in the universities; (5) For the endowment of poor undergraduates; (6) For the endowment of post-graduate research.

DR. OLIVER LODGE made some novel suggestions as to the time, place and purpose of University examinations, in his address to the students of the University of Birmingham on November 28. His proposals amount

essentially to this—that examinations should not immediately follow teaching, and that a vacation interval should intervene for private study and revision, quiet thought, assimilation and digestion. Students should not be taken straight from a lecture-room into an examination room, so that they might tell the examiner what the professor had said before they had time to forget it. So he wished to urge that a long vacation should be left between instruction and examination; that the examinations be held in September instead of at the end of June. If no interval for rumination was afforded during student days, if the unrooted ideas were pulled up for inspection by the examiner at the end of each session, and the student turned loose in the holidays empty, swept and only partially garnished, for a period of complete idleness before another filling-in process began, then the last state of that man was liable to be little better than the first. The principle underlying Dr. Lodge's proposals is sound enough, but there are difficulties and objections in the application. What, for instance, is to prevent the student who wishes to obtain a good place in the examination at the commencement of the session

from devoting his holidays to study when he ought to be gaining physical strength and enjoying mental relaxation?

THE Emperor of Germany has given his consent to further reforms in the educational systems of the higher schools of Prussia, and a summary of the edict is given in the *Times*. The general education received in the three kinds of schools, the Gymnasium, the Realgymnasium and the Oberrealschule, is to be regarded as of the same value, and as only requiring to be supplemented in so far as for several branches of study and for several professions special preliminary knowledge is necessary which is not included in the curriculum of all three institutions. In accordance with this consideration, the desirability of extending the privileges of the Realgymnasium and the Oberrealschulen is to be kept in view. By this means it is hoped to raise these schools in public estimation, and to render an acquaintance with modern subjects more general. In view of the great importance of a knowledge of English, his Majesty lays stress upon the necessity of giving more attention to that subject in the Gymnasium. English is to be taught as an alternative subject to Greek in all the classes of those schools, except the three highest. Where the local conditions are favourable to the alteration, English is to take the place of French as a compulsory subject in the three highest classes. French, however, is to be retained as a voluntary subject wherever this change is made. The Emperor further regards it as advisable that more time should be given to geography in the higher Realschulen than has hitherto been the case. In the teaching of modern languages importance is to be attached to fluency in speaking and to the understanding of current authors.

SCIENTIFIC SERIALS.

Bulletin of the American Mathematical Society, November. —The only paper in the present number is a note on geometry of four dimensions, by Prof. Lovett, which was read before this society on April 28 of this year. The writer indicates nine well-defined "trends" which the speculations relative to the geometry of n -dimensional space have followed, and directs his work to following up two out of these, viz., the interpretation of this geometry in the light of the theory of groups as exhibited by Lie, Klein and Poincaré and the extension of the methods of ordinary differential geometry to general spaces, i.e. as worked out by Christoffel, Beltrami, Cesàro, Darboux and others. This he does by constructing four dimensional space by the method of Lie's theory of continuous groups, and studying curves of triple curvature by the intrinsic analysis developed by Cesàro in his *Lezioni di geometria intrinseca*.—An account of the proceedings at the recent International Congress held at Paris is furnished by Miss C. A. Scott, in which she abstracts the addresses by Prof. Cantor, sur l'histoire de la mathématique, and Prof. Volterra, trois analystes italiens, Betti, Brioschi, Casorati. Several of the papers communicated are lightly but clearly handled, and M. Poincaré's presidential address, du rôle de l'institution et de la logique en mathématiques, is concisely analysed. She plainly speaks her mind on many points of detail.—Dr. G. A. Miller gives an account of the 49th Annual Meeting of the American Association for the Advancement of Science so far as it relates to the work of the society. The meeting was held at Columbia University, June 23—30, and from the point of view of scientific work it is said to have been one of the most successful that has been held by the association. About twenty papers were read in section A., some of which are given in brief abstract.—In the "notes" additional particulars (to those given in the October number) are given of the mathematical courses to be followed in the coming winter at British and Continental colleges.—Personal details as to deaths and new appointments, with the usual "new publications," close the number.

In a paper on new and critical British Algae, in the *Journal of Botany* for October, Mr. E. A. L. Batters describes no less than three new genera of sea-weeds:—*Neevea*, belonging to the Bangiaceæ, represented by *N. repens*, endozoic on *Flustra foliacea* at Deal; *Rhodophysema* (Florideæ), founded on *R. Georgii*, growing on *Zostera marina* off the Scilly Islands; and *Erythrodermis* (Florideæ), represented by *E. Alleni*, dredged up from 4–6 fathom water at Plymouth.—In the number for November Mr. Pearson describes and figures a new liverwort, *Lejeunea Macvicari*, from Inverness-shire; and Mr. E. S. Salmon a new parasitic fungus belonging to the Erysiphææ, *Uncinula septata*, from Japan.

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SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 15.—"Data for the Problem of Evolution in Man. VI.—A First Study of the Correlation of the Human Skull," by Alice Lee, D.Sc., with some assistance from Karl Pearson, F.R.S., University College, London.

November 22.—"On the Restoration of Co-ordinated Movements after Nerve Crossing, with Interchange of Function of the Cerebral Cortical Centres." By Robert Kennedy, M.A., D.Sc., M.D.

Zoological Society, November 20.—Dr. W. T. Blanford, F.R.S., Vice-President, in the chair.—Mr. Sclater stated that during a recent short stay at Gibraltar he had visited the haunts of the Barbary Ape (*Macacus inuus*), at the top of the Rock, and had ascertained that the herd of these animals was in a flourishing condition, and had considerably increased during the last few years.—An extract was read from a letter from Sir Harry Johnston, K.C.B., containing indications of a supposed new species of the Horse-family (Equidæ) which appeared to inhabit the Great Congo Forest, near the Semliki River, East Africa.—Mr. G. A. Boulenger, F.R.S., exhibited and made remarks on one of the type-specimens of a new species of *Protopterus* from the Congo, for which he had proposed the name of *Protopterus dolloi*.—Dr. W. T. Blanford, F.R.S., exhibited and made remarks upon a very fine pair of horns and some skins of the Central-Asiatic Wapiti, lent to him for examination by Mr. Rowland Ward.—Mr. F. E. Beddard, F.R.S., read a paper on the Osteology of the Pigmy Whale (*Neobalaena marginata*), based mainly on an examination of one of the specimens of this animal in the British Museum. A detailed description of the skeleton was given, and the features in which it differed from that of other known forms of the Cetaceans were pointed out.—Prof. Howes, on behalf of Prof. Baldwin Spencer, F.R.S., gave a description of *Wynyardia bassiana*, a fossil Marsupial from the Tertiary Beds of Table Cape, Tasmania. It was remarkable as being the first fossil Marsupial obtained from the Tertiaries of Australia, and appeared to be a Polyprotodont, having affinities with the Didelphid, Dasyurid, and Phalangistid series, which had probably struck off from the rootstock at the period at which the Diprotodonts were in course of evolution.—A communication from Mr. L. A. Borradaile contained an account of a collection of Arthrostracans and Barnacles from the South Pacific.—Mr. Oldfield Thomas read a paper on the Mammals obtained by Dr. Donaldson Smith during his latest expedition from Somaliland by Lake Rudolf to the Upper Nile. Twenty-three species were enumerated, and five forms described as new. Dr. Smith had also obtained some fine examples of the true Bohor of Rüppell (*Cervicapra bohor*) and of the Bush-buck described by Heuglin as *Tragelaphus bor*, which proved to be a tenable sub-species of *T. scriptus*.—Mr. W. L. Distant read a paper on the Rhynchota belonging to the family Pentatomidæ in the Hope Collection at Oxford. It constituted a revision of the catalogue of the Hope Collection written by the late Prof. Westwood in 1837. All the specimens had been examined by the author, and the species relegated to modern genera and much synonymy removed, while several new genera were described in the paper.—A communication was read from Mr. R. C. Punnett, containing an account of the Nemertean collected by Prof. Haddon in Torres Straits. They comprised examples of seven species, four of which had been previously described, whilst the remaining three were new.

Royal Meteorological Society, November 21.—Dr. C. Theodore Williams, President, in the chair.—A communication was read from the International Meteorological Committee inviting observations of the form, amount and direction of the clouds on the first Thursday of each month during 1901, as well as on the preceding and following days. These observations are to be made in connection with the balloon ascents which will be carried out under the direction of the Aërostation Committee.—Mr. R. H. Curtis exhibited an improved mounting for the lens and bowl of the Campbell-Stokes sunshine recorder, by means of which the glass ball can be quickly and accurately placed centrally in the bowl, where it is secured by clamping screws.—Mr. W. H. Dines read a brief paper on the weekly death-rate and temperature curves, 1890–99. He exhibited diagrams showing the death rate of the thirty-three great towns of England, and also curves of the temperature at Greenwich. The author is of opinion that, from the health point of view, the English climate is one of the best in